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Search for Heavy Right Handed Neutrinos at the FCC-ee

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The Standard Model of particle physics is still lacking an understanding of the generation and nature of neutrino masses. A favorite theoretical scenario (the see-saw mechanism) is that both Dirac and Majorana mass terms are present, leading to the existence of heavy partners of the light neutrinos, presumably massive and nearly sterile. These heavy neutral leptons (HNLs) can be searched for at high energy lepton colliders of very high luminosity, such as the Future electron-positron e^+e^- Circular Collider, FCC-ee. A first look at the FCC-ee sensitivity in direct search for heavy neutrino decays is presented, which appears very promising due to the long lifetime of heavy neutrinos for small mixing angles. A sensitivity down to a heavy-light mixing of 10^{-12} is obtained, covering a large phase-space for heavy neutrino masses between 10 and 80 GeV/ c^2 . The synergy with a possible future beam-dump experiment, SHiP, would allow to explore most of the parameter space for HNLs of the ν MSM, a minimal Standard Model extension aimed at simultaneously explaining the matter-antimatter asymmetry of the Universe and the phenomenon of neutrino oscillation, while also providing a light dark matter candidate.

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